



High Impact Additive Formulation for Premium Cements

The Indian Cement Consumer - specifically in the organized segment, is becoming increasingly sophisticated and demanding. With the rapid growth in the organized (non-trade) segment of the cement market, the demand for premium and specialty cements has also grown multi-fold in recent years. One such cement, which is witnessing high demand from the pre-cast and high grade concrete manufacturers, is Premium OPC with high 1-day strength.

One of the leading cement manufacturers in India was looking to manufacture and supply a similar Premium OPC through one of their plants in South India. However, this specific plant faces certain limitations on the clinker strength, which in turn was restricting the compressive strength gain to 21 MPa at 1-day, even with higher fineness than normal.

At the state-of-the-art UNISOL-STAREX Research Centre in Noida, we have been working on some high-impact, cutting-edge grinding aid formulations catering to custom needs of our customers. We were asked by this Cement Group to demonstrate the impact on 1-day strength by using one of our newly developed Grinding Aid formulation at this plant of theirs.

The trials were conducted at plant-scale. Provided below is an overview of the trial structure and the results.

Product Details

- Custom blend with following chemicals in the given proportions:
 - NTR-10 (proprietary; powder-form): 20%
 - PCE based additive (proprietary; liquid-form): 10%
 - Water: 70%
- Recommended dosage: 0.04-0.06% by weight of cement mill feed
- Additives were supplied in concentrated form.
- Blending and mixing with water was conducted on the customer site delivering added advantages in terms of:
 - Reduction in costs associated with freight, duties and handling of bulky liquids.
 - Increased flexibility in terms of managing concentration and properties of the grinding aid solution.

Trial Duration and Quantities

- Target cement production: 6000 tons
- Additive quantities delivered for the trials:
 - NTR-10: $6000 \times 20\% \times 0.06\%$ (maximum recommended dosage) = 0.72 Tons (approximately 700 KG)
 - PCE based additive: $6000 \times 10\% \times 0.06\% = 0.36$ tons (approximately 350 KG)

Infrastructure and Trial Approach

- UNISOL deployed the following infrastructure and team for ensuring maximum value delivery through the product:
 - Entire mixing and dosing assembly constituting of mixing tanks with agitators, dosing-pump, transfer-pump, etc.
 - Trained technicians for supervising the mixing and dosing protocols.
 - Senior process engineers for optimization of process parameters and dosage.

Picture 1: On-Site Blending of Additives for Reduced Cost





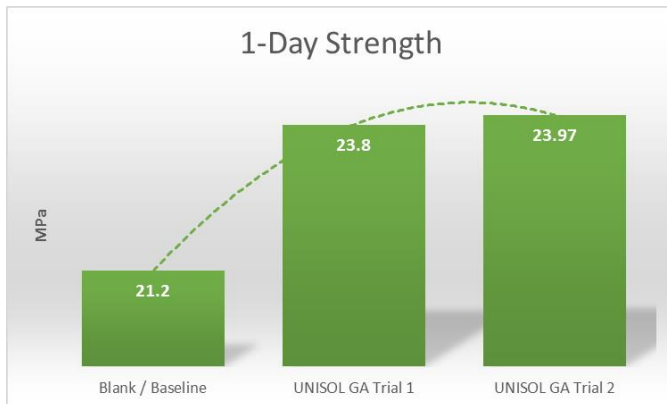
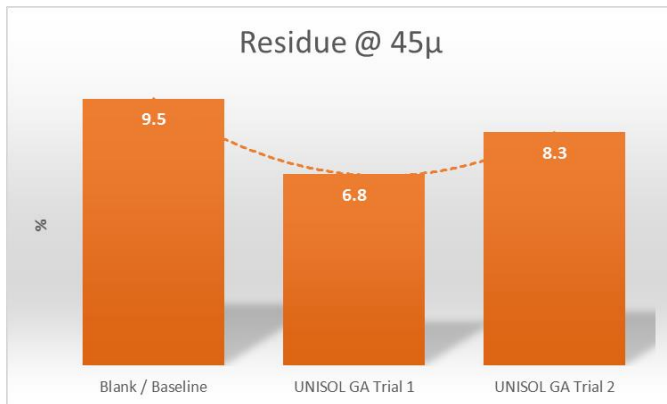
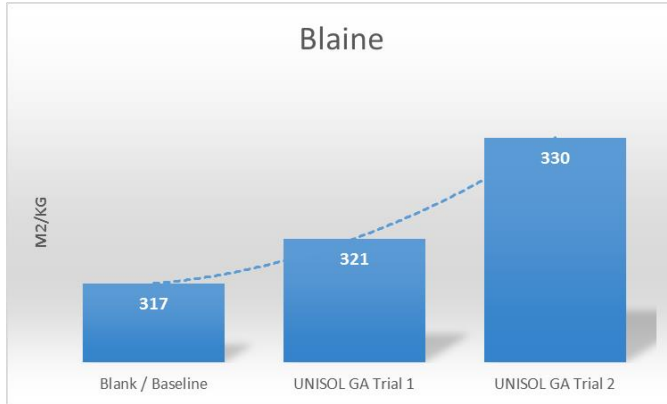
- Plant was requested to adhere to the following conditions:
 - Clinker, gypsum and fly ash used in blank and grinding aid trials were all of the same quality and taken from the same storage area.
 - The cement composition was kept the same during both blank and grinding aid trials (i.e. same clinker, fly ash, gypsum contents).
 - Mill output observed during the blank trials was maintained throughout the trials with grinding aid. Grinding aid caused the mill to perform better. Separator RPM would need to be adjusted to ensure that the output remains the same as that during the blank trials. Blaine during grinding aid trials were kept higher as compared with blank trials; residue at 45/90 microns was kept lower during grinding aid trials as compared with blank trials.
 - Clinker was a consistent liter weight.
- A blank trial run was conducted both before and after the grinding aid trials.
- Hourly samples were collected and composite samples were made out of the hourly samples.
- All physical, chemical and process parameters were constantly monitored and recorded throughout the course of the trials.
 - Hourly process parameters such as Cement composition (TPH of each component, Feed characteristics (size, dustiness), Mill Output (TPH), Mill power (kWh), Ancillary power (e.g. elevator kW), Circuit temperatures (e.g. mill exit, separator exit), Separator settings
 - Physical and chemical data of the composites including blaine, residue, PSD, compressive strength, NC.

Summary of Results: High Performance Cement

Trial Run Description	Blaine	Residue @ 45 μ	1-Day Strength
Blank / Baseline	317	9.5	21.20 MPa
UNISOL GA Trial 1	321	6.8	23.80 MPa
UNISOL GA Trial 2	330	8.3	23.97 MPa

- The compressive strength growth at 1-day by using our custom GA formulation was higher by approximately 2.7 MPa as compared with blank / baseline strength.

Chart 1: Comparison of Physical Properties: Blank vs UNISOL GA Samples



- This allowed the plant to start making and supplying high performance OPC, which is supplied to demanding customers in the pre-cast and high grade concrete segments.

UNISOL – STAREX INDIA RESEARCH CENTRE

This one-of-a-kind research and innovation centre has been set-up to cater to the ever-evolving needs of the Indian Cement Industry. The team, at the Research Centre, aims to develop advanced chemical additives, grinding aids and quality improvers, customized for the distinct requirements of various cement plants and producers.

